

Near Infrared Photon Migration Optic Probe for Breast Core Needle Biopsy

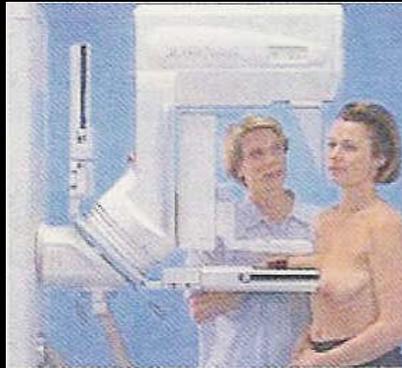
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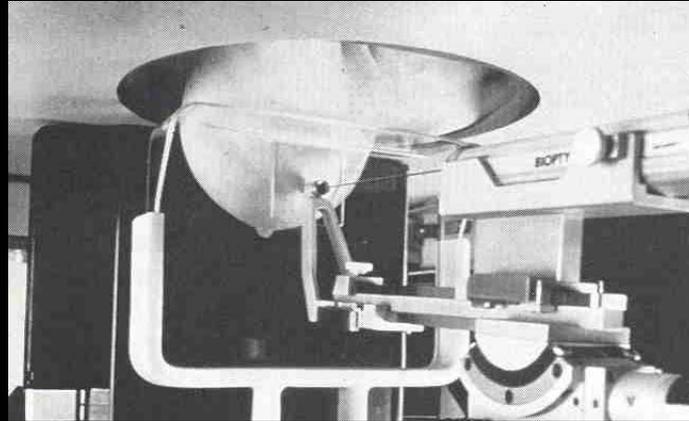
Supported by EB002742



Breast Cancer Screening and Diagnosis

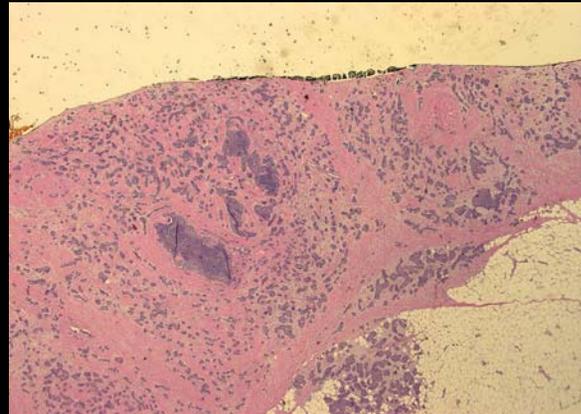


Screening



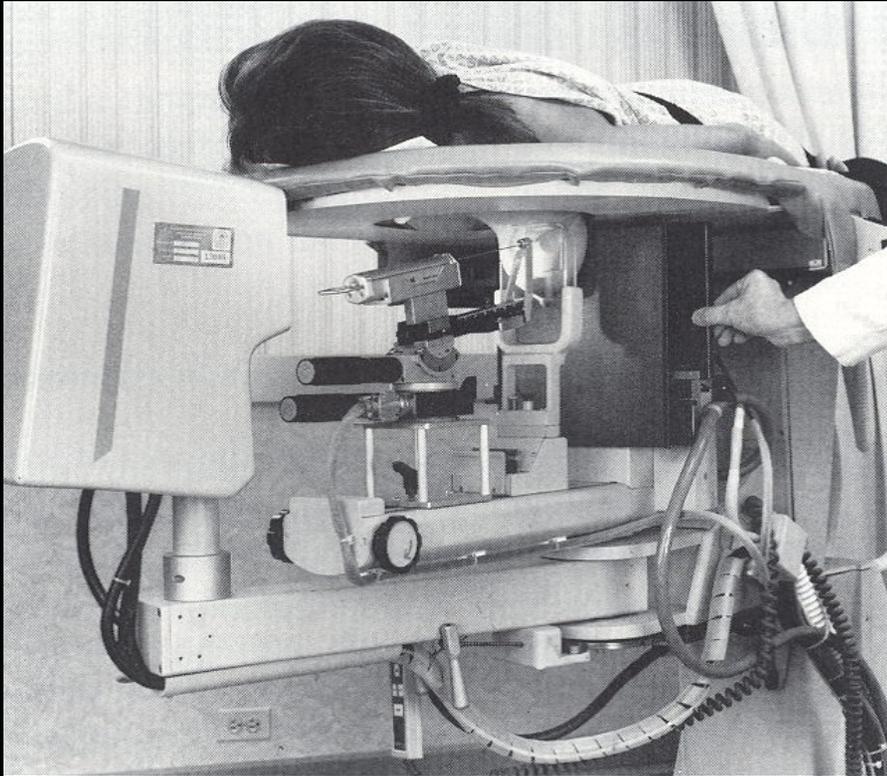
Diagnosis

Histology



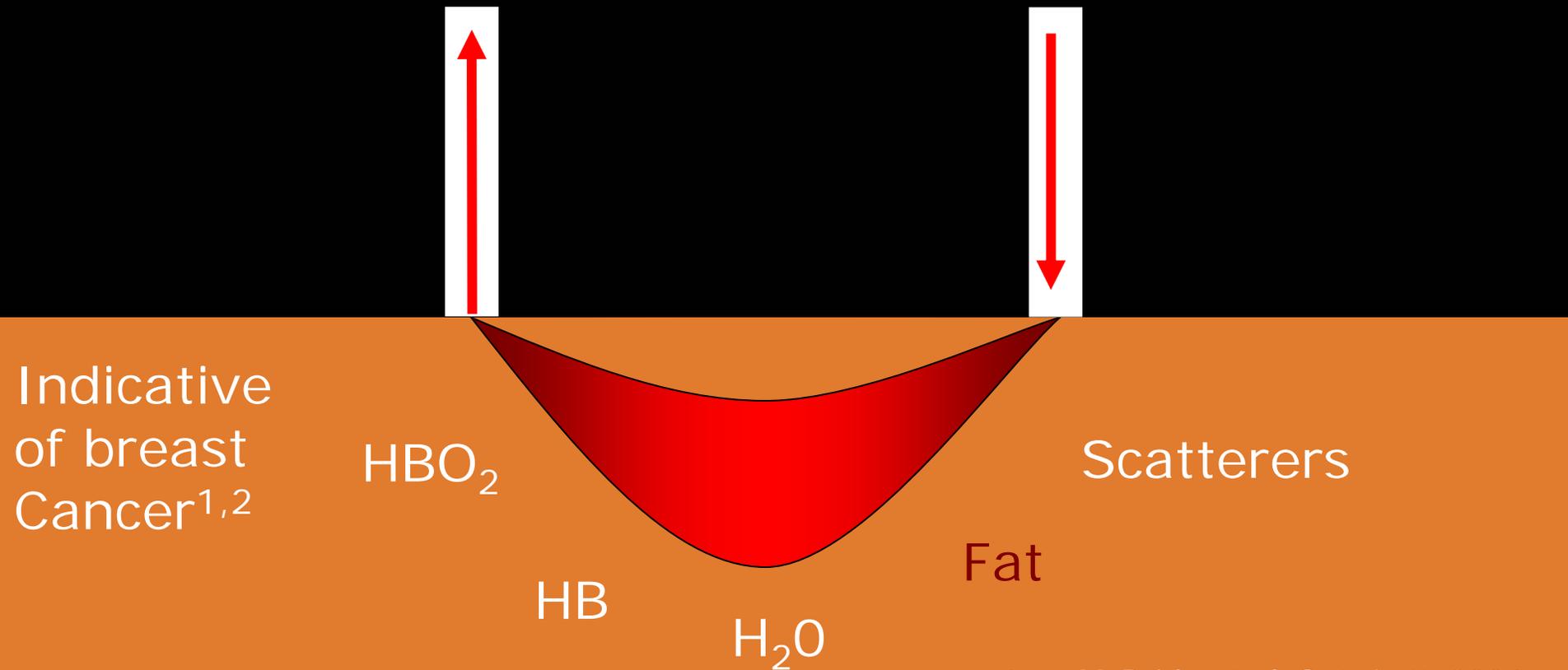
Clinical Problem

- 1 million breast needle biopsies annually¹
- False negative rate up to 8%²
- Repeat biopsy rate up to 7%³



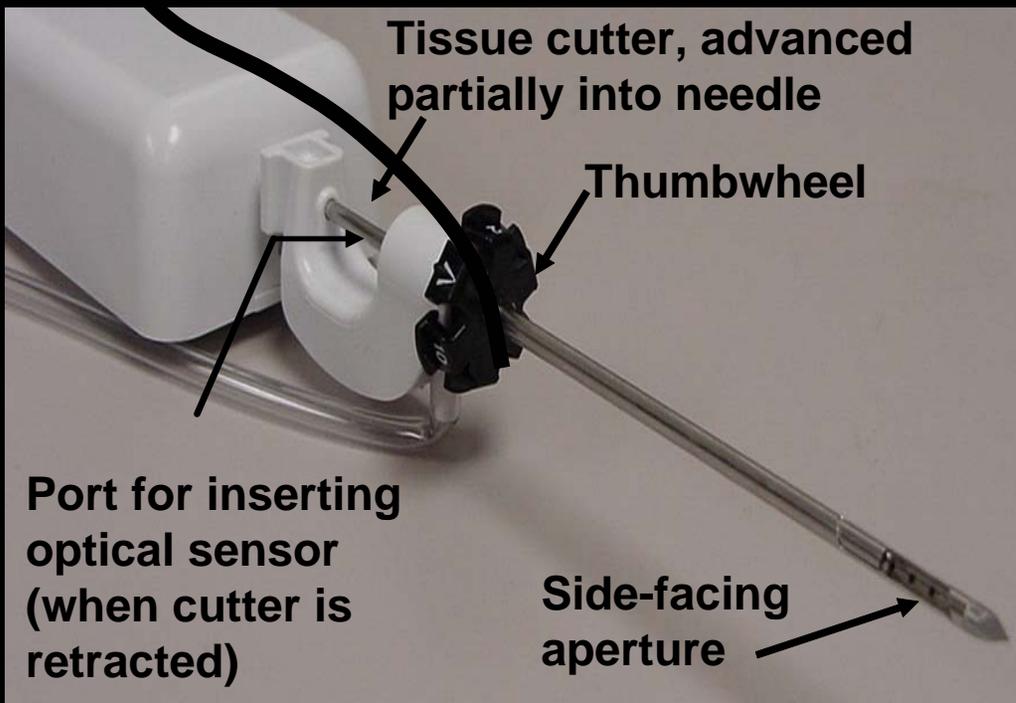
1. Liberman *Radiol. Clin. N. Am.* 2000
2. Pfarl et al. *Am. J. of Roentgenology* 2002
3. Liberman et al. *Radiology* 1998

Photon Migration Spectroscopy



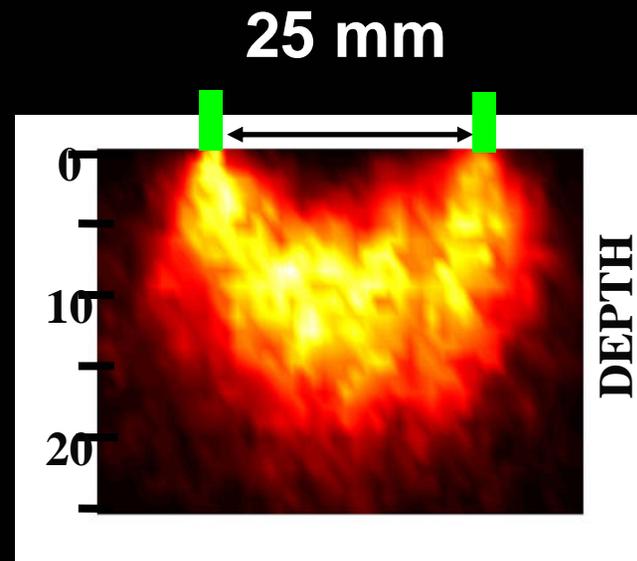
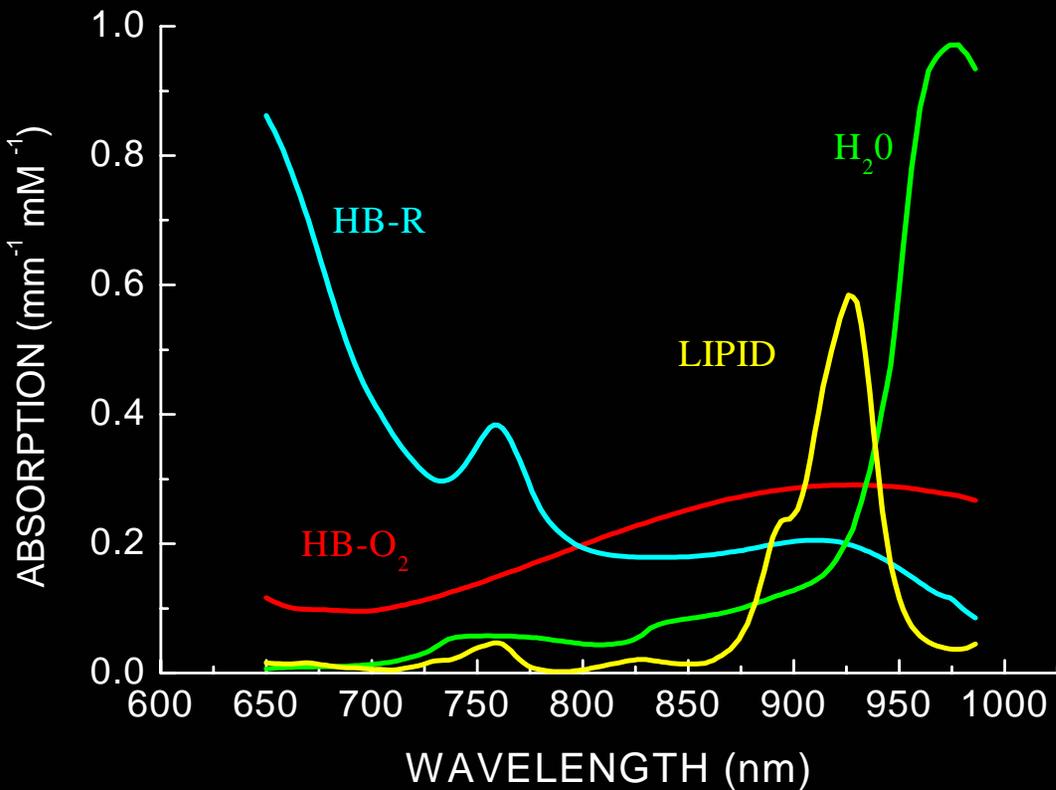
1. McBride et al *Opt. Lett.* 2001
2. Tromberg et al *Neoplasia* 2000

Integrating Optical Sensors into a Breast Biopsy Needle

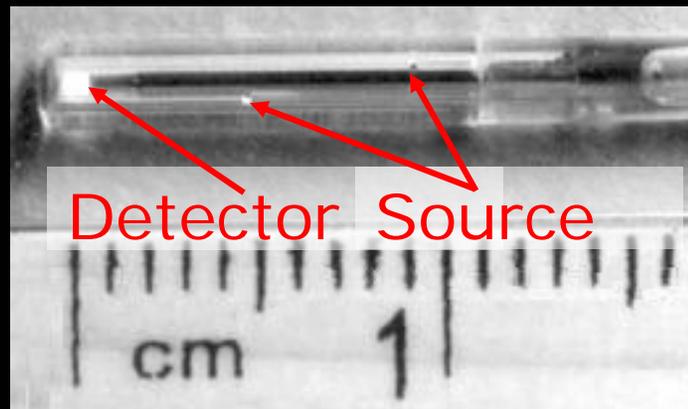
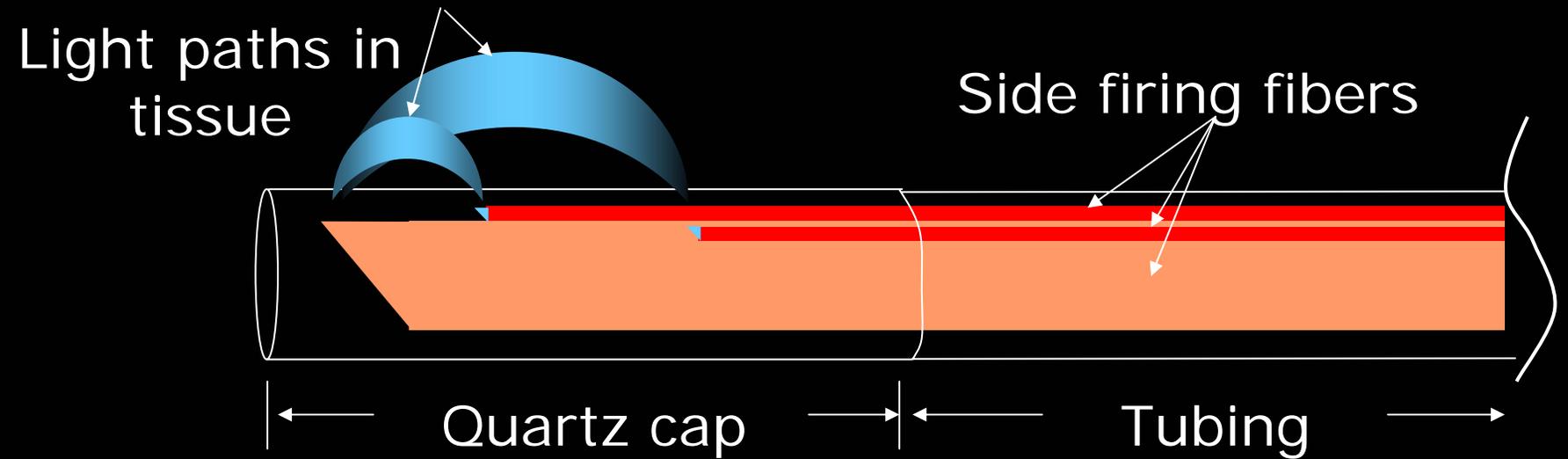


- **Probe Features:**
 - Measure hemoglobin, water and lipid absorption
 - Maximize sampling volume in the breast

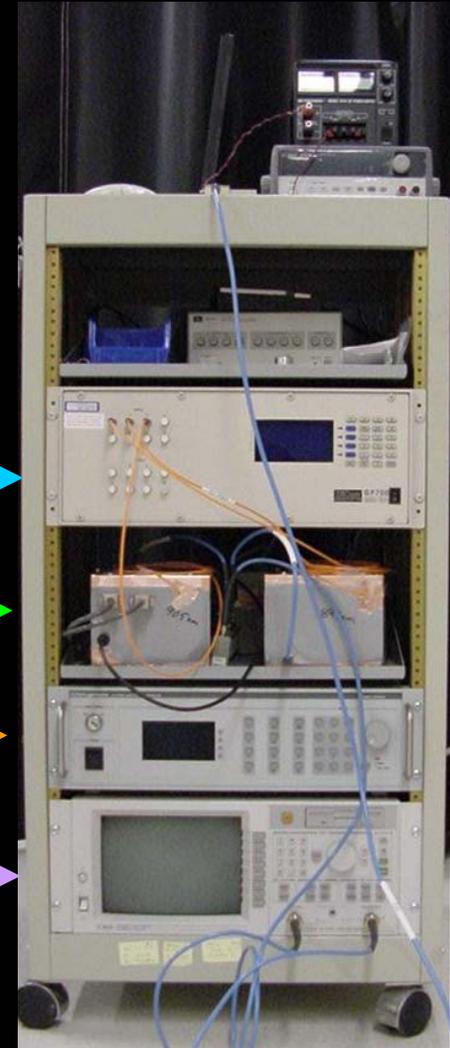
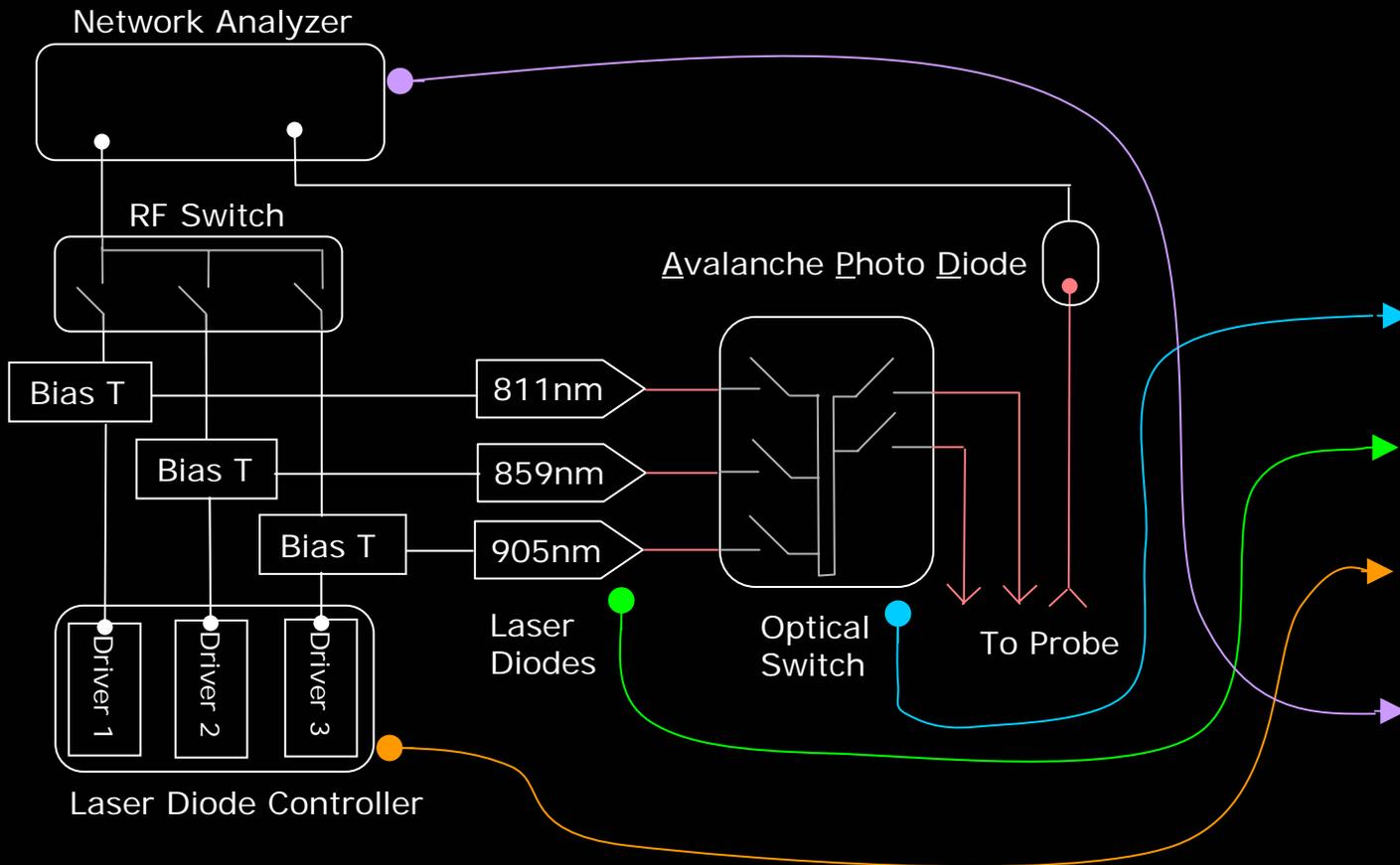
Dominant NIR Absorbers



The Probe



The Instrument (Frequency Domain)



Homogeneous phantom

- Represent normal and diseased breast^{1,2}
- $\mu_s' = 10\text{cm}^{-1}$
- $\mu_a = 0.02 - 0.20\text{cm}^{-1}$
- Agar, intralipid, India ink
- $\sim 7\text{cm} \times 7\text{cm}$

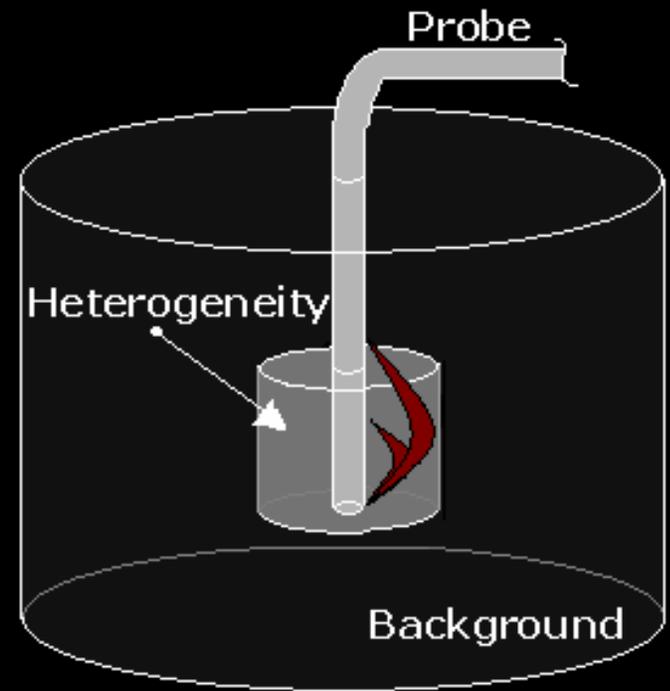


1. Tromberg et al. *Neoplasia* 2000
2. McBride et al. *Opt. Lett.* 2001

Heterogeneous semi-solid phantom

Simulate lesion inside normal breast tissue

	Background normal breast tissue	Heterogeneity breast lesion
μ_a (cm ⁻¹)	0.05	.10-.20
μ_s' (cm ⁻¹)	10	10
Radius (mm)	NA	2.5-15



Summary

- Accurately measure optical properties of most homogeneous phantoms.
- $< 30\%$ measurement error for heterogeneities $\geq 10\text{mm}$
- Model for other endoscopic photon migration probes.

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